



Early Journal Content on JSTOR, Free to Anyone in the World

This article is one of nearly 500,000 scholarly works digitized and made freely available to everyone in the world by JSTOR.

Known as the Early Journal Content, this set of works include research articles, news, letters, and other writings published in more than 200 of the oldest leading academic journals. The works date from the mid-seventeenth to the early twentieth centuries.

We encourage people to read and share the Early Journal Content openly and to tell others that this resource exists. People may post this content online or redistribute in any way for non-commercial purposes.

Read more about Early Journal Content at <http://about.jstor.org/participate-jstor/individuals/early-journal-content>.

JSTOR is a digital library of academic journals, books, and primary source objects. JSTOR helps people discover, use, and build upon a wide range of content through a powerful research and teaching platform, and preserves this content for future generations. JSTOR is part of ITHAKA, a not-for-profit organization that also includes Ithaka S+R and Portico. For more information about JSTOR, please contact support@jstor.org.

the sale and use of poisons and of poisonous drugs in all parts of the country. Such a law would also afford dealers doing an interstate business an opportunity to determine with reasonable certainty whether any particular article should be handled as a poison or not, and in the event that an article is to be handled as a poison the regulations and restrictions in the several States might be made reasonably uniform.

THE SANITATION OF IQUITOS, PERU.

By G. M. CONVERSE, Acting Assistant Surgeon, United States Public Health Service, in charge of the sanitation of Iquitos.

A sanitary campaign for the improvement of the public health of Iquitos was begun in January, 1913, and continued until July 1, 1914.

The death records for the 10 years preceding 1913 show an average annual mortality rate of 40.56 per 1,000 inhabitants, increasing to an average of 46.58 for the last 3 years and to 49.52 for 1912.

During the first year of the work the death rate fell to 28.88, and during the first six months of 1914 to 21 per 1,000 inhabitants.

The birth rate for the five-year period preceding 1913 was 62.64 per 1,000 inhabitants per annum; for 1913 it was 64.

Description of Iquitos.

Iquitos is a Peruvian port for ocean-going vessels, 2,300 miles from the mouth of the Amazon River. It lies less than 4° south of the Equator, on a bank composed of clay and sand, facing a branch of the river about half a mile wide and separated from the main stream by a long and narrow island; it is otherwise hemmed in by swamps and impenetrable jungle.

The average temperature the year round is about 30° C. (86° F.), with high humidity, the rainfall during the first nine and a half months recorded being 2,349.11 mm. (93 inches). It rained on 182 days out of 305 days recorded.

The town has 12,754 inhabitants, mostly Indian. In lieu of a sewer system it has about 18 kilometers of open drains—a succession of mosquito-breeding pools. There is no public water supply. Its streets are unpaved; many of them are boggy and marshy; some are covered with a rank growth 3 to 4 feet high, others with both water and vegetation. It has no hospital and no public clinic.

The recorded death certificates show diagnoses of yellow fever, malaria, malarial cachexia, anemia, diarrhea, fevers, etc. More than one-half of all deaths are registered "of cause unknown," owing to the decedents not having been seen ante mortem by a physician.



A TYPE OF STREET IN IQUITOS WITH OPEN SEWER.



A TYPE OF STREET IN IQUITOS.



THE POOR CAN SCREEN BARRELS EFFECTIVELY AT LOW COST.



SOME OF THE PATIENTS OF THE DAY'S CLINIC.

The plan had been for the writer to take up the medical problems and conduct the necessary campaigns in conjunction with an engineer who was to draft plans, furnish specifications, construct a sewer system, install a public water supply, and pave the streets. Owing to a financial crisis produced by the low market price of crude rubber (this article having been the "raison d'être" of the town) the engineer's portion of the program came to an abrupt termination with the completion and official acceptance of his plans and specifications.

In the course of this relation it may then be remembered that, although our conduct of operations was necessarily influenced by the proposed program, no change whatsoever has taken place in the condition of the sewers, streets, or water supply, and therefore that such change as has occurred in the public health of the town can be fairly attributed solely to the measures adopted.

Yellow Fever.

For various reasons the first work to be done was the eradication of yellow fever.

Statistics of this disease in Iquitos are not to be had. Up to a few years ago the "vomito negro," or black vomit, of Iquitos was supposed to be a disease peculiar to the locality, even though the clinical and epidemiological histories of the cases were identical with those of yellow fever. This attitude and its results prove the fallacy of the practice peculiar to certain cities of denying at any cost and as long as possible the presence in their midst of important epidemic diseases. Among the people, even of the better class, the mode of transmission of the disease was unknown, and, what was worse, the positiveness of the old beliefs made the beginning of operations somewhat stormy. The plan adopted, which we believe to be applicable to all localities in which yellow fever has been present for a number of years, and which, therefore, contain a sufficient number of immunes to prevent an explosive outbreak of the disease, has had but one object, the location and destruction of the breeding places of the *Stegomyia*; that is to say, no fumigation for the purpose of destroying adult *Stegomyiæ* was done; not one house was fumigated. The immediate result was to cut the cost of the work in half and at the same time remove the greatest source of friction with the people. The reasons which compelled us to adopt this course were the following:

Remoteness from markets, requiring several months to obtain the necessary material.

Open construction of the houses, rendering efficient fumigation impracticable without an expensive outfit for covering in the entire house.

High cost and low efficiency of labor.

Limited funds.

The belief, created by an appreciation of the conditions, that there was a good percentage of immunes, and therefore an unlikelihood of an explosive outbreak of the disease, and that without fumigation and solely by destruction of the larvæ a rapid diminution of the *Stegomyia* could be obtained, with consequent cessation of human cases.

During the antiplague operations in San Francisco in 1907-8, conducted by Surg. (now Surg. Gen.) Rupert Blue, it was observed that it was not necessary to destroy all rats before human and even rat plague disappeared, but that when a certain proportion of the rats had been destroyed infection ceased; the rats were the links in the chain of infection, and the chain was broken. Again, Col. Gorgas has insisted, both at Habana and Panama, that it is not necessary to destroy the last *Stegomyia* to see yellow fever disappear, but that when the number of *Stegomyia* has been diminished to a certain minimum, yellow fever ceases; again the chain of infection is broken by insufficiency of the links—in this case the *Stegomyia*.

The various steps of the work have been:

Employment and training of native inspectors.

The passage of the necessary ordinance.

Obtaining the necessary larvacidal material.

Cleaning up, screening, destruction of larvæ.

Educating the people.

These measures require no comment, save that the larvacidal materials used were the same as those used at Panama, with this exception, that instead of costing 18 cents a gallon all prepared it cost us over 70 cents gold a gallon and has been accordingly handled with considerable care. Kerosene was used until we could obtain the above-mentioned materials, and it cost us 65 cents gold a gallon. Crude oil was out of the question, as the freight alone was over \$10 a barrel.

The burden of cleaning up and screening water containers was placed entirely on landlords and tenants.

We began work during a lull in the epidemicity in January, 1913. There had been no deaths from yellow fever registered for several months, but within a few days four cases of local origin, all occurring in foreigners recently arrived, made their appearance, and a few days later three more cases were brought in by steamer from the city of Manaos, the nearest neighbor, 1,100 miles down the river. Two of the latter patients fell ill in the town the day after arrival, and in

one of the cases the first day and night were passed without any screening whatever. The steamer was fumigated.

There was no hospital at Iquitos and the immediate measures that were taken consisted in seeing that the cases remained under mosquito netting and in covering with kerosene every container of water in the infected blocks and the four adjoining blocks to each case each day until they could be properly screened. It was hoped in this way to destroy the females which, gorged with infected blood, might resort to the water containers for oviposition. No secondary cases occurred, although, as stated above, in at least one of the cases, a fatal one, the first day and night of illness were passed without any screening whatsoever.

Theoretically and under laboratory protection, the life of the *Stegomyia* appears to be a long one, 154 days in one case,¹ but practically, and under the conditions of open houses, absence of clothes closets, little furniture—in short, a minimum of protection against winds, rain, and the natural enemies of the mosquitoes—the completion of the screening of water containers was followed in about two weeks by an almost complete disappearance of *Stegomyia* in the territories screened.

In the absence of a public water supply, sewerage, and even of official levels in any part of the town, it was not found possible to order work of a permanent nature done; a householder could not be compelled to do away with the roof gutters which collected his water, nor with barrels and tanks which stored it, when there was no other way for him to obtain his supply of water. Permanent work of any character was very expensive owing to the high cost of materials and labor.

The actual work of the campaign presents no interest, the usual thousands of inspections, screenings, abatement of nuisances, cart-loads of tins, etc., removed being the same as in all work of this character. The net results of these routine operations and general clean-up are that, although in previous years yellow fever had never failed to be present in epidemic form at some time of the year, there has not been one case of the disease since February, 1913 (18 months), and the general mortality rate dropped from 49.52 in 1912 to 28.88 in 1913. That this diminution in mortality was not produced by a reduction in population was shown by census and also by the birth rate, which rose from 59 in 1912 to 64 in 1913.

¹ Guiteras, Juan, 1904a, in *Yellow Fever* by Jos. Goldberger, *Yellow Fever Bulletin* No. 16.

Distribution of Mosquito Larvæ.

The breeding waters of the mosquitoes found in Iquitos have been remarkably constant for each species.

The larvæ of the four principal species found have been met with as follows:

Stegomyia fasciata in all artificial containers of water, and in these only, such as wells, tanks, barrels, water jars, tins, bottles, roof gutters, flower pots, insect guards, chicken drinking cups, various fruit shells lying on the ground, hollow tree-stumps, latrines, launches and canoes hauled up on the bank or lying in the river, holds of vessels, and coal barges. They were sought for in banana plants, in palms, and bromeliaciæ, but were not found there. *Stegomyia* larvæ have never been found in the open sewers, street or private, nor in natural pools in the streets, gardens, or marshes. A tin bottle or other receptacle lying in the open sewer will contain *Stegomyia* larvæ, while the water of the ditch itself may be almost black with the larvæ and pupæ of another *Culex*, *mansonia*.

Mansonia titillans is found in millions in the succession of pools of the 18 kilometers of open-ditch sewers, in the private sewers leading from the patios of the houses to the street sewer, and in the marshes surrounding the town. *Culex pipiens* and *Culex fatigans* are found in the marshes, in natural pools, and in the natural wells used by the public for the washing of clothes.

Neither larvæ nor adult *Anopheles* were met with either in Iquitos or within several miles of the town.

Summary of Measures Against Yellow Fever.

The measures adopted for the control of yellow fever at Iquitos may be summed up as follows:

1. Mosquito-proofing of all artificial containers of water.
2. Making all other collections of water unfit for the development of the larval stage of *Stegomyia* and, incidentally, of other mosquitoes, by the addition, as done at Panama, of larvacide, at intervals shorter than the time required for the completion of the pupal stage.
3. General cleaning up of houses, yards, and gardens, the removing therefrom of all unscreenable containers of water, and the cutting of grass, bushes, etc., in yards and gardens, which was ordered for the sole purpose of permitting an inspector to note, without loss of time, the presence or absence of collections or collectors of water. With the exception of the infected steamer no fumigation was done.

Uncinariasis.

We estimate that out of a total of 12,754 inhabitants, 9,500 to 10,000 are infected with or harbor *Necator americanus*, and that this infection is responsible for more than one-half of the deaths as the mortality now stands.

This general estimate is made after microscopical examination of the stools of the inhabitants of two widely separated blocks, after treating some 1,500 cases, and from general observation. There being no hospital, no information could be obtained from such a source. As stated before, the records show deaths due to anemia, pernicious anemia, geophagia, gastro-enteritis. Malarial cachexia is a frequent diagnosis.

The reasons for this widespread infection appear to be in part as follows: Of the 3,098 houses, over 2,000 had no toilet whatever, the inhabitants soiling their gardens, the streets, vacant lots, etc. In the presence of an average temperature of 86° F., with high humidity and frequent rains, it is evident that if there were eggs of *Necator americanus* in stools they would find ideal conditions for their development.

About 10,000 persons, children and adults, walk barefooted all or part of the time; many who wear shoes in public go barefooted in their infected yards and gardens; the majority can not afford to buy shoes.

The open street sewers require frequent excavation, because of the caving in produced by the torrents of rain which go tearing through them; the infected sand and clay are spread over the roadway on either side of the central ditch.

The floors of the poorer houses are of beaten earth, and frequently quite damp; there is much carelessness in the preparation of food and as to where it is placed.

In order to obtain some knowledge of the actual amount of soil infection present, a microscopical search of 87 samples of surface soil was made. These samples were taken from all parts of the town, from gardens, yards, streets; they were selected from spots not fully exposed to the sun and from such places as might at some time have been soiled with feces. In 49 samples, or 56 per cent, larvæ of *Necator* were found; they were not seen in 38 samples, or 44 per cent. In the examination of these negative samples four or five slides were gone over carefully.

In addition, 16 samples of soil from sewer bottoms were examined; only 1 sample showed larvæ of *Necator*.

Eggs of *Ascaris lumbricoid* were found in two samples of surface soil and in one of sewer bottom.

A protozoon undistinguishable from *Balantidium coli* was found in two specimens; both came from the shaded edges of small puddles of water to which pigs had access.

The microscopical examination of the stools of the inhabitants in the two outlying blocks gave the following results: 128 persons furnished specimens; of these, 103, or 80 per cent, showed eggs of *Necator*.

The infection is even greater than this, for a number of specimens not showing eggs were fluid and at the time we did not have a centrifuge. Without centrifuging it may be very difficult to find eggs in such a specimen, although the person may be in a very serious condition. Several more specimens contained so much earth and sand that they could not be examined. About the same proportion showed eggs of *Ascaris Lumbricoid* and of *Trichocephalus trichiurus*; *Strongyloides stercoralis* was found in 11 specimens and *Ameba dysenterica* in 2. The fundamental remedies for this condition of affairs lie, of course, in the proper disposal of all excrement, a supply of pure water, and the wearing of shoes, and, failing in these, in the adoption of some compromise measures. The critical state of the public and private finances of the Department of Loreto, already referred to, has interfered with the carrying out of any extensive measures.

As soon as circumstances permitted, permission was obtained from the prefect, Col. Puente, to open a clinic for the poor, and to furnish the medicines, the latter being dispensed on contract by a local drug store.

It was realized that it would not be possible to treat all cases, nor for that matter to obtain permanent cures while the occasions for reinfection remained all about; the objects sought were to teach the people the cause of their anemia, and that it could be cured by appropriate treatment, and to obtain accurate and sufficiently voluminous data for the information of the Government.

The results were:

Total cards issued.....	1,765
Treatment refused for various reasons.....	257
Total persons treated.....	1,508
Number of specimens of stools examined.....	3,523
<hr/>	
Ages:	
0-1.....	12
1-3.....	74
3-15, male.....	386
3-15, female.....	355
15-30, male.....	121
15-30, female.....	262
Over 30, male.....	66
Over 30, female.....	232
Total.....	1,508

Treatment was refused persons who were not poor, children under 15 or 16 years of age coming alone, advanced cases of tuberculosis, and persons coming for various other complaints.

With the exception of the 12 infants treated for errors in feeding, all of the cases showed infection to a greater or less extent.

Number treatments received.	Number treated.
1.....	572
2.....	364
3.....	250
4.....	171
5.....	89
6.....	23
7 and more.....	27
Total	1,496

These figures have little meaning except as indicating the number of treatments. For instance, the reason the 572 cases were treated only once was not that they were cured but that most of these patients rushed to the clinic during the last week, when it was announced that it would be closed.

There was so much irregularity in the way the cases came that no results can be given except to state that all cases, with the sole exception of those heavily infected with *Trichocephalus*, showed immediate improvement and appeared cured after three or four treatments, as a rule.

With very few exceptions these 1,496 persons showed, on microscopical examination of the stools, not only eggs of *Necator americanus*, but also of *Ascaris lumbricoides* and of *Trichocephalus trichiurus*.

	Cases.
Uncinariasis complicated with—	
Balantidium coli.....	8
Amebic dysentery.....	8
Trichocephalosis	3

By trichocephalosis is meant cases showing so many eggs of the whipworm in the stools, presumably corresponding to a heavy infection, as to give the cases a different clinical aspect and certainly a different prognosis from the usual hookworm case.

Among the 1,508 patients treated 2 deaths occurred, 1 of a girl of 6, who was brought to the clinic in a hopeless condition of uncinariasis complicated by amebic dysentery; the other, a boy of 11, also carried to the clinic in a bad condition, and showing at the first examination 60 eggs of *Trichocephalus* to a field (1.5 mm. diam.), with a scattering of *Necator*; a week later there were 20 eggs of *Necator* to a field, while two slides had to be searched before one *Trichocephalus* egg could be found; a week later there were 8 to 10

eggs of each to a field. On each occasion the boy was given 1.50 grams thymol, and appeared to be improving. We lost sight of him until a month later, when a certificate of death appeared, signed by a local physician, with the diagnosis of abdominal tuberculosis.

The symptomatology, physical signs, and the course of the uncinal infection here are identical with those given in detail in the various papers of Ch. Wardell Stiles, in the reports of the Porto Rican Commission (Ashford, W. S. King, and Igaravidez) and elsewhere. Extensive repetition is therefore superfluous. We have also followed the same mode of treatment.

Children, up to 14 or 15 years of age, even when markedly stunted in their growth, with severe anemia and protuberant abdomen, either complain of nothing or, rarely, of dizziness or pain at the epigastrium, and when asked to point out the location place the fingers over a point midway between the xyphoid appendix and the umbilicus. The parents bring them because of their pallor and anorexia; 75 per cent of these are stunted, boys of 17 and 18 looking like normal boys at 13 years of age. Adults complain, in their order of frequency, of pain at the epigastrium, pain between the scapulæ, headache, dizziness, palpitations, weariness on the slightest exertion, anorexia; women also complain of amenorrhea and dysmenorrhea. This series is so constant that at times it appears as if word had been passed around that these were the proper symptoms to give.

As soon as the clinic grew to such proportions that it became evident that we could no longer handle it alone assistants were employed to attend to all the nonmedical portions.

It may be of assistance to others to describe the machinery adopted when but one physician is in charge. The prospective patient was received by an office boy, who handed him a number in the order of his arrival. He passed on to a clerk, who filled out the portion of a clinical card concerning name, age, etc. This card was given to the patient. In the order of his arrival he reached the treatment room and went to the microscope. We were fortunate in obtaining as one of our inspectors a young Peruvian, José Cardenas, who had spent two years in the medical department of the Georgetown University and who took over this portion of the work. With frequent verifications of his work and personal examinations of all doubtful cases, diarrhetic stools, and such other as were deemed necessary, the system worked well. The patient brought a match box or a bottle containing feces, and the microscopical findings were noted on the card; the patient then passed to us for the clinical history, physical examination, and treatment.

As the clinic had of necessity to be confined to uncinariasis, the latter consisted in a variation in the dose of thymol, santonin, iron, the mode of administration remaining the same.

We found very early that much of our time was taken up in giving each patient the same directions and precautions to be observed, especially with the torpid mental condition of such patients. Another inspector was taught this portion of the work. The instructions were all printed on a sheet for distribution, but a majority of the patients could not read.

The physical examination was confined to the condition of the conjunctival and buccal mucous membranes, the condition of the lungs, heart, arteries, spleen, liver; general state of the abdomen; presence or absence of edema; and general development.

Of the patients examined only two showed organic lesions of the heart, both being mitral insufficiency and both patients having enlarged spleens and giving histories of malaria acquired outside of Iquitos. This absence of organic disease of the heart is in conformity with the absence in Iquitos of many of those infectious diseases the tendency of which is to invade the serous linings of the heart.

Arteriosclerosis was notably absent, even in old patients.

The spleen: Adults or children who had never lived outside of Iquitos never showed enlargement of the spleen. On the other hand, persons having lived in certain localities in the interior invariably showed a large spleen, so much so that seeing the name of their birth-place on the card at once informed us that we should find a large spleen on percussion.

The liver was normal in size. We did not have many adult men, and of the women, only one showed an enlarged liver, and this apparently due to alcoholism.

Geophagia.—The following substances are eaten by patients, adults and children, suffering from uncinariasis: Clay, uncooked or baked in flat cakes; earth; sand; rags; paper; uncooked rice; tobacco; ashes; coffee grounds; pulverized brick. The eating of these articles is called "el vicio," or "the vice," and the patients are ashamed of the habit and admit eating earth or clay very reluctantly. It was almost impossible to teach the people that "the vice" was not the cause of the anemia, but only one of the symptoms of hookworm infection.

Prevailing Morbid Conditions of Iquitos, Other than Yellow Fever and Intestinal Parasites.

The birth rate of Iquitos showed an annual average of 62 per 1,000 population for the five-year period 1908-1912; of 64 per 1,000 for the year 1913.

Infantile mortality (0-1 year) for the same five-year period was 188 per 1,000 births. In 1913 it was 153 per 1,000 births, the causes of this mortality being similar to those elsewhere.

Tuberculosis, particularly pulmonary tuberculosis, was present, but to what extent it was difficult to ascertain.

There were from 12 to 15 known lepers at large in the town; efforts made to properly isolate them failed because of lack of funds. Measles and whooping cough were present in epidemic form from time to time. In August, 1913, there were about 700 cases of measles, which, although of mild character, caused a distinct rise of the mortality rate in September.

According to the local physicians and my own observations during the time of my residence in Iquitos, the following infections have never been known to occur in the town: Typhoid, scarlatina, diphtheria, acute lobar pneumonia, rabies, plague, and cholera.

PLAGUE-ERADICATIVE WORK.

CALIFORNIA.

The following report of plague-eradication work in California for the week ended October 24, 1914, has been received from Surg. Long, of the United States Public Health Service, in charge of the work.

SAN FRANCISCO, CAL.

Premises inspected.....	1,860
Premises destroyed.....	4
Nuisances abated.....	293
Poisons placed.....	20,400
Average number of traps set daily.....	1,317

RATS COLLECTED AND EXAMINED FOR PLAGUE.

Collected.....	655
Found dead.....	2
Examined.....	575
Found infected.....	None

RATS IDENTIFIED.

<i>Mus norvegicus</i>	378
<i>Mus rattus</i>	99
<i>Mus alexandrinus</i>	102
<i>Mus musculus</i>	76

RATS TAKEN FROM STEAMERS.

(Not included above.)

Steamer *Bee*:

<i>Mus alexandrinus</i>	2
<i>Mus rattus</i>	1

SAN FRANCISCO, CAL.—Continued.

RATS TAKEN FROM STEAMERS—continued

Steamer *Rainier*:

<i>Mus alexandrinus</i>	8
<i>Mus rattus</i>	1

Bark *Brizeux*:

<i>Mus alexandrinus</i>	15
<i>Mus rattus</i>	5

PORT COSTA, CAL.

Rats trapped in sugar refinery.....	23
Rats trapped in warehouses.....	21
Rats trapped on water front.....	8
Rats examined.....	47
Pounds of poison placed (bread).....	3

RATS IDENTIFIED.

<i>Mus norvegicus</i>	15
<i>Mus musculus</i>	10
<i>Mus alexandrinus</i>	20
<i>Mus rattus</i>	17